5.11 PRODUCT WATER QUALITY

The following section is based on the Municipal Water District of Orange County 2000 Urban Water Management Plan (December 20, 2000), the Huntington Beach Seawater Desalination Plant Pressure Surge Analysis (January 16, 2003), the Distribution System Corrosion Control for Desalination Seawater (September 27, 2002), and the Disinfection Byproduct Formation Report (March 2004).

EXISTING CONDITIONS

Four water sources (imported water from the Metropolitan Water District of Southern California [MWD], surface water, groundwater, and recycled water) are currently managed, treated and distributed through the Orange County distribution system to customers throughout Orange County. The potable water quality within the Orange County distribution system is in compliance with all regulatory drinking water standards. A description of the regulations currently applicable to the existing potable water supply within Orange County (and which would also be applicable to the proposed project) is provided below.

REGULATORY FRAMEWORK – DRINKING WATER

Department of Health Services – Title 22

The California Department of Health Services (DHS) administers all provisions relating to the regulation of drinking water to protect public health. California's Safe Drinking Water Act requires DHS to administer laws relating to drinking water regulation, including setting and enforcing both federal and State drinking water standards, administering water quality testing programs, and administering permits for public water system operations. The standards established by DHS are found in Title 22 of the California Code of Regulations (CCR).

The DHS is responsible for ensuring that all public and private water systems are operated in compliance with drinking water regulations. Current drinking water regulations include both primary and secondary standards. Compliance with primary standards is mandatory, because these standards are based on potential health effects on water users. The primary standards define maximum concentration levels (MCLs) that cannot be exceeded by any public and private water system. All standards except turbidity are applicable at the water user's tap. Secondary standards are those parameters that may adversely affect the aesthetic quality of drinking water, such as taste and odor. These standards are not federally enforceable, although DHS reserves the right to enforce secondary standards if warranted.

Under Title 22 of the California Code of Regulations, DHS would regulate the operation of the Seawater Desalination Facility at Huntington Beach and would oversee the quality of the product water produced. In addition, DHS would be responsible for ensuring that the product water blended with existing water supplies would meet the minimum recommended standards for contaminants in drinking water that has been established by the United States Environmental Protection Agency (EPA).

To comply with the DHS regulatory requirements, the applicant would apply for a domestic water supply permit as a water supply wholesaler pursuant to the Regulations Relating to Domestic Water Systems. This includes the submission of:

- A Water Quality Emergency Notification Plan (ENP);
- An Engineering Report describing how the proposed new facilities would comply with the treatment, design, performance and reliability provisions of the Surface Water Treatment Rule (SWTR); and
- A Facility Operations Plan.

Permit provisions for similar municipal water supply projects typically include:

- Submittal of plans and specifications for Department approval prior to construction;
- Compliance with the Surface Water Treatment Rule (SWTR) – including the treated water turbidity, disinfection residuals and CT levels;
- All water must be treated – no bypassing;
- Complete water quality analyses conducted by an approved laboratory;
- Adequate corrosion control;
- Updated watershed sanitary survey every five years;
- Mandatory use of American National Standards Institute (ANSI) and National Safety Foundation (NSF) approved chemicals;
- Raw water bacteriological monitoring;
- Certified treatment facility operators; and
- Submission of monthly operation reports and a report after the first year of operation detailing the effectiveness of the facility's performance, a list of any violations and a list of any needed additions or operational changes.

Santa Ana Regional Water Quality Control Board (SARWQCB) – Basin Plan

As part of its Triennial Review of the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan), the SARWQCB reviewed the recommendations of a Task Force report of the 1995 total dissolved solids (TDS)/Nitrogen Management Plan for the basin. This review resulted in the 2004 adoption of an amendment to the Basin Plan that could impact water quality discharge limitations in water reclamation permits leading to increased permit limits of several key water quality constituents:

- Revision of numerical water quality objectives for TDS in the Irvine Groundwater Management Zone. The new water quality objective is 910 mg/L.

- Deletion of numerical groundwater quality objectives for individual mineral constituents, such as sodium and chloride. These have been replaced with narrative water quality objectives: chloride concentrations shall not exceed 500 mg/L in groundwaters of the region designated MUN and sodium concentrations shall not exceed 180 mg/L in groundwaters designated MUN.

IMPACTS

As the proposed project would introduce an entirely new source of potable water into the Orange County water supply system, the following information analyzes the quality of potable water produced by the desalination facility and its potential impacts on existing potable water quality and the distribution system within Orange County. An analysis of the desalinated product water's compliance with regulatory drinking water standards is provided, in addition to a description of potential impacts to existing water supplies in regards to corrosion, chlorine residual, disinfection bypdroducts, taste/odor, and hydraulics.

Significance Criteria

Under the CEQA Guidelines a project may be considered to have a significant environmental effect if it would:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);
- Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;
- Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed; and/or
- Otherwise substantially degrade water quality.

PROPOSED PRODUCT WATER QUALITY

The product water quality from the Seawater Desalination Project at Huntington Beach can be potentially impacted by the following factors:

- Ocean Water Quality Fluctuations
- Ocean Water Red Tide Algal Bloom Event
- HBGS Non-Routine Operations
- Reverse Osmosis (RO) Membrane Performance

These potential impacts on product water quality are discussed below.

Ocean Water Quality Fluctuations

The product water of the proposed seawater desalination facility may be impacted by natural changes in ocean water salinity, temperature, turbidity and pathogen concentration. Typically, ocean water salinity and temperature changes are triggered by natural seasonal events. As discussed in Section 5.10, *OCEAN WATER QUALITY* and the Watershed Sanitary Survey (Appendix E), the intake ocean water turbidity and pathogen concentration changes are mainly driven by rain events.

In order to maintain a consistent quality of desalinated product water, the applicant would be required to obtain a drinking water permit from the California Department of Health Services (DHS) that would address monitoring of source water quality and its effects on product water quality. The applicant has been working with DHS for the last four years to obtain such a permit. On August 10, 2002, DHS issued a conceptual approval letter for the Seawater Desalination Project at Huntington Beach.

The desalination facility intake water quality in terms of turbidity (which is a surrogate indicator for potential elevated pathogen content) and salinity would be measured automatically and monitored continuously at the desalination facility intake. Instrumentation for continuous monitoring and recording of these parameters would be installed at the desalination facility intake pump station. In event of excessive increase in intake seawater turbidity and/or salinity, this instrumentation would trigger alarms that would notify desalination facility staff. If the intake pathogen count reaches a preset maximum level, this instrumentation would automatically trigger chlorination of the source water, thereby reducing the source water pathogens to acceptable levels even before the water reaches the RO treatment facilities**.** In addition to the automation provisions, turbidity and salinity would also be measured manually by the desalination staff at least once a day and the intake seawater would be analyzed for pathogen content at least once per week. In the event of elevated intake seawater turbidity, laboratory pathogen content analysis would be performed more frequently.

In addition to the intake water quality monitoring instrumentation, the desalination facility pretreatment filtration facilities would be equipped with filter effluent turbidimeters and particle counters. This equipment would allow facility operators to continuously monitor pretreatment filter performance and to trigger adjustments of desalination facility operations to accommodate intake water quality changes.

Desalinated product water quality would also be monitored continuously for salinity and chlorine residuals and would be tested frequently for pathogen content.

In summary, desalinated product water quality would be tested in accordance with the requirements of the California Code of Regulations (Title 22) and the DHS. Product water quality impacts due to ocean water quality fluctuations are not anticipated to occur upon implementation of the design features described above.

Red Tide Algal Bloom Events

Occasionally, in late summer and fall, the surf zone along the Pacific Ocean may experience excessive growth of red-pigmented algae (phytoplankton), which “bloom” and accumulate into dense visible patches near the ocean surface such that the water appears to be colored red. This phenomenon is commonly known as “red tide”. During a red tide event, some of the algae produce elevated concentrations of specific organic compounds (such as the biotoxins saxitoxin and domoic acid) and store these compounds in their cells. Typically, the concentrations of organic compounds produced during red tide events are not harmful for humans if the ocean water is ingested directly. Oysters and other shellfish such as clams, mussels and scallops can accumulate and concentrate these organic compounds in their tissues in excess of 1,000 times. Therefore, directly ingested red-tide ocean water typically does not cause harm to humans, while consumption of shellfish that has high concentrations of organic compounds generated during red tides may result in harm.

Red tides are natural phenomenon usually occurring when temperature, salinity and nutrients in the ocean reach suitable levels to trigger a red tide bloom. The exact combination of factors that trigger red tide blooms is presently unknown, but some experts believe that high temperatures combined with lack of rainfall are at the root of red tide events. There are no known ways to control red tides. Therefore, the desalination facility would be designed to maintain high quality potable water (consistent with regulatory standards) in the event of a red tide event.

The Seawater Desalination Project at Huntington Beach would have a number of provisions/barriers to protect against the passage of red tide-related algal organic compounds through the treatment processes. These provisions/barriers are described below:

- Deep Intake Configuration to Minimize Algae Entrainment: Most of the algal biomass during red tide events floats on the surface. The HBGS intake (the source from which the desalination facility would divert seawater from) is located at depth of approximately 33 feet below the water surface. Algal presence, accumulation and growth at this depth are minimal because of the limited access of sunlight, which is vital for algal growth.

  HBGS intake water is collected through a velocity cap atop a rectangular intake tower. The maximum mean water velocity at the inlet to the intake conduit is only two feet per second (fps), which minimizes collection of red tide algae from the ocean surface, where they are most abundant. Because of the low intake velocity and significant depth of the outfall, the amount of the algae that would be entrained along with the intake water and would be conveyed to the desalination facility would be minimized, thereby protecting the desalination facility from exposure to significant amounts of red tide-related algal organic compounds.

- Chlorination of Intake Seawater: The desalination facility intake pump station would be equipped with a sodium hypochlorite feed system which would be used for intake seawater chlorination on as needed basis. During episodes of red tide/algae blooms, chlorine would be applied at dosages of three to five mg/L. Chlorine is a strong oxidant, which, applied at the high dosages indicated above, would reduce the concentration of red tide-related algal organic compounds in the seawater, thereby further minimizing their content in the facility product water. In addition, intake seawater chlorination upstream of the pretreatment sand filters would significantly decrease algae growth in the filter cells.

  Chlorination of intake source water is a method commonly used for controlling algal blooms in conventional water treatment facilities applying direct filtration. At present, a significant portion of the intake water sources in the US are surface water sources occasionally exposed to algae blooms (reservoirs, lakes, slow-flowing portions of rivers). Typically, conventional treatment facilities applying granular media filtration and chlorination as key treatment methods are effective in treating surface water at times of algae blooms.

- Enhanced Coagulation of Intake Seawater: The desalination facility pretreatment filters would be equipped with a coagulant (ferric sulfate or ferric chloride) feed system, which would be applied continuously at the seawater intake at dosages of five to 10 mg/L. During episodes of red tide/algae blooms coagulation dosage would be increased to up to 20 to 30 mg/L to achieve enhanced coagulation and removal of algae from the intake water.

- Microfiltration or Dual Media Sand Filtration Algae Barrier: Algae conveyed with the intake seawater would be retained in the filter media and removed from the filters during filter cell backwashing. Because algae cells are the carrier of the red tide elevated concentration of algal organic compounds, their physical removal in the dual media filters would significantly reduce the potential for release from the algal biomass into the seawater that would be processed in the downstream treatment facilities (cartridge filters and RO membranes). Filter effluent water turbidity is expected to be maintained in a range of 0.05 to 0.3 nephelometric turbidity units (NTU).

- Microfiltration or Dual Media Sand Filter Covers: The surface of all pretreatment filters and filter channels would be covered to minimize sunlight exposure. Filter cell covers have proven to be an effective measure for minimizing algae growth in the filter cells. In combination with chlorination and enhanced coagulation, this measure would assure that the intake water algae are effectively retained and their growth in the filter media suppressed.

- Cartridge Filter Algae Barrier: The pretreatment filter effluent would be processed through five-micron cartridge filters located downstream of the granular media filters and ahead of the RO membranes. The size of the openings of these filters is an order of magnitude smaller than the size of the red tide algae cells. Therefore, the cartridge filters would provide an additional protection barrier in terms of algae cell propagation. The cartridge filter effluent would be practically devoid of all red tide algae and algal particles.

- RO Membranes: Reverse osmosis membranes are very effective in removing soluble compounds of molecular size smaller than the size of the red tide algal organic compounds. The proposed membrane elements at the seawater desalination facility would be capable of removing more than 99.6 % of the chloride ions contained in the seawater. Because the membrane elements work as physical barriers, they would also be very effective in removing organic molecules several times larger than chloride ions, such as these of the red tide algal organic compounds. The reverse osmosis membrane system is projected to remove more than 99 % of the red tide algal organic compounds remaining in the seawater, which would assure safe and reliable product water quality.[1] In addition, a study completed by the US Army Biochemical Research and Development Laboratory in 1993 also clearly indicates that reverse osmosis treatment is an effective method for removal of algal organic compounds, including saxotoxin.

- Final Disinfection: The permeate from the reverse osmosis system would be disinfected with chlorine followed by ammonia addition for chloramination. This final barrier of algal organic compound inactivation would provide additional assurance in terms of product water quality and safety.

- Emergency Facility Shutdown: Desalination facility operation can be discontinued within 10 minutes after notification in the event of red tide/algal blooms of catastrophic proportions or advisory by pertinent local and state heath safety agencies. Red tide genesis and development are usually closely followed by local agencies. Red tide growth to a level of a major calamity usually happens in a matter of days rather than minutes. Continuous communication with pertinent regulatory agencies in the times of red tide conditions would allow ample time for emergency shutdown in extreme cases of red tide occurrence.

Seawater desalination facilities using RO membranes similar to those proposed for the Seawater Desalination Project at Huntington Beach have operated successfully for more than 15 years in other parts of the world with scarce alternative water resources (Spain, Cyprus, Israel, the Middle East and the Caribbean). In all of these locations red tide/algal blooms have occurred occasionally in the past. The fact that there are no documented cases of red tide health or safety problems associated with the operation of RO seawater desalination facilities worldwide is indicative of the capability of these systems to perform reliably and effectively under red tide conditions. Thus, less than significant impacts are anticipated in this regard.

HBGS Non-Routine Operations

Unusual activities at the HBGS, such as seawater emergency intake pump shut downs and failures, electricity equipment malfunctions, excessively high temperature of the cooling water, etc., may impact product water quality and desalination facility performance.

The Seawater Desalination Project at Huntington Beach would have six different provisions incorporating several protection/notification devices to account for non-routine operations at the HBGS:

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1 Letter from Hydranautics to Poseidon Resources Corporation, June 18, 2002.

- Automatic control interlock between HBGS pumps and desalination facility intake pumps: The shutdown controls of the desalination facility intake pumps would be interlocked with the HBGS pumps, so when HBGS pump operation is discontinued to prepare for heat treatment, non-routine or even routine pump shutdown, this would automatically trigger an alarm at the desalination facility along with shutdown of the desalination intake pumps. After this emergency shutdown, the intake pumps would have to be started up manually, and the operations staff would be required to check the reason of shutdown with the HBGS staff before restarting the treatment facility intake pumps.

- Continuous Intake Pump Flow Measurement Devices: Seawater intake pumps would be equipped with flow meters, which would record the pumped flow continuously. If the intake flow is discontinued for any reason, including non-routine HBGS operations, this would trigger automatic intake pump shutdown.

- Continuous Intake Water Temperature Measurement Devices: The desalination facility intake pump station would be equipped with instrumentation for continuous measurement of the intake temperature. Any fluctuations of the intake temperature outside preset normal limits would trigger alarm and intake pump shutdown. This monitoring equipment would provide additional protection against heat treatment or other unusual intake water quality conditions.

- Continuous Intake Water Salinity/Conductivity Measurement Devices: The desalination facility intake pump station would be equipped with instrumentation for continuous measurement of the intake seawater salinity. Any fluctuations of the intake salinity outside preset normal operational limits would trigger an alarm and initiate intake pump shutdown. This monitoring equipment would provide additional protection against discharge of unusual fresh water/surface water streams in the facility outfall.

- Continuous Intake Water Oil Spill/Leak Detection Monitoring Devices: The desalination facility intake pump station would be equipped with instrumentation for oil spill/leak detection. Detection of oil in the intake water even in concentrations lower than 0.5 mg/L would automatically trigger an alarm and initiate intake pump shutdown. This monitoring equipment would provide additional protection against unusual intake water quality conditions.

- Routine Communication with HBGS Staff: The desalination facility staff of each shift would be required to contact HBGS personnel at least once per shift and enquire about unusual planned or unplanned events at the HBGS. If non-routine operations are planned at the HBGS, the desalination facility would be informed and would modify desalination facility operations accordingly.

Implementation of the six provisions described above would minimize impacts in this regard to less than significant levels.

Reverse Osmosis Membrane Performance

As the RO membrane elements age, their rejection capabilities decrease. This may trigger a change in product water quality from the Seawater Desalination Project at Huntington Beach.

The RO system membrane performance would continuously monitor feed seawater and permeate conductivity and the differential pressure through the membranes. If permeate salinity (i.e. total dissolved solids [TDS]) concentration exceeds the design level, membranes would be cleaned to recover their original performance capabilities. In addition, an average of 10 to 15 percent of the membrane elements would be replaced every year, thereby maintaining the product water quality at a steady level.

The Seawater Desalination Project at Huntington Beach would produce product water with lower TDS levels than that currently delivered to Orange County water purveyors by MWD. The TDS product water quality estimate of 350 mg/L is based on the use of high-rejection seawater desalination membranes at the second year of desalination facility operations. Typically, during the first two years of facility operations, the average product water quality TDS concentration would be lower than 350 mg/L. After the second year of operations, a portion (typically 10 to 15 percent per year) of the desalination facility membrane elements would be replaced to maintain the product water quality close to the target TDS concentration of 350 mg/L. Membrane replacement is a standard approach commonly used in seawater desalination facilities to maintain product water quality at a long-term steady target level. In addition, chloride and sodium are estimated to average 180 mg/L and 120 mg/L, respectively.

These estimated water quality levels for TDS, chloride, and sodium are well below the newly adopted narrative water quality objectives in the amended Basin Plan and when the desalinated water is integrated into the water supply system it is unlikely that recycled water would exceed the amended Basin Plan narrative water quality objectives.

The desalination facility would use industry standard eight-inch desalination membrane elements, which are available from a number of specialized membrane manufacturers. The membrane element manufacturers and their products pre-qualified for this project are:

- Hydranautics (SWC3 or better)
- Filmtec/Dow (SW30HR-380 or better)
- Koch/Fluid Systems (TFC2822SS or better)
- Toray (SU820L or better).

Key design membrane element parameters common for the products of these suppliers are:

- Membrane Type: Spiral-wound, thin film composite;
- Applied Flux: eight to 12 gpd/sf at recovery rate of 45 to 50 percent;
- Nominal Salt Rejection: 99.6 percent or higher;
- Applied Pressure: 800 to 1,100 pounds per square inch (psi);
- Maximum Pressure Drop per Element: 10 psi;
- Maximum Feed Water SDI (15 min): 5.0;
- Free Chlorine Resistance: less than 0.1 mg/L;
- Operating pH Range: two to 11; and
- QA/QC Membrane Production and Testing Procedures.

The actual membrane element that would be used for the proposed desalination facility would be selected during the detailed engineering design phase of this project. The product water projections are performed for two conditions: new membranes at facility start up and membranes at the second year of facility operations. All projections are completed for low flow scenario conditions in terms of intake water salinity and temperature and membrane performance characteristics.

At the beginning of the desalination facility operation the TDS concentration of the RO system permeate is projected to be between 226 and 308 mg/L, and at the end of the second year of desalination facility operations is projected to be between 257 and 349 mg/L (based on projections of product water quality and membrane performance in accordance with modeling specifications provided by two of the four membrane suppliers, Toray and Hydranautics). As previously indicated, the permeate water quality would be maintained at a second-year operations level over the entire 30-year period of facility operations by replacement of a portion of the membrane elements every year. It should be noted that the projections above are for the water quality of the RO system permeate as it exits the desalination system. Prior to distribution, the desalination facility permeate would be conditioned by lime and carbon dioxide for stabilization and corrosion control, and with chlorine for final disinfection. The addition of these conditioning chemicals would increase the final product water TDS concentration by 30 to 50 mg/L. Therefore, at facility start-up the TDS of the product water delivered to the distribution system is expected to be in a range of 260 to 340 mg/L, while for the entire 30-year period of facility operations the TDS concentration would be in a range of 300 to 400 mg/L and would average 350 mg/L.

The projections presented above are developed using conservative assumptions for the type and performance of the membrane elements, intake water salinity and temperature. The applicant's previous pilot testing experience in Tampa and Carlsbad and the actual performance of the same Toray membranes in Trinidad indicate that the membrane manufacturer projections carry a safety factor of 10 to 15 percent and the actual product water quality is always better than that projected by the software.

Advances in membrane technology over the next 30 years are expected to yield membrane elements capable of producing water of TDS concentration below 300 mg/L for most of the useful life of the desalination facility. Therefore, the projected product water TDS concentration of 350 mg/L is a reliable and conservative estimate of the potable water quality that would be delivered to the distribution system by the Seawater Desalination Project at Huntington Beach.

As described in Section 3.0, *PROJECT DESCRIPTION*, the facility would be capable of meeting all drinking water standards through multiple treatment processes, which include: pretreatment filters; cartridge filters; reverse osmosis membranes; and product water conditioning and disinfection facilities. A comparison between the product water quality of the Seawater Desalination Project at Huntington Beach and the DHS primary and secondary water quality standards is presented in Table 5.11-3, *PRODUCT WATER QUALITY COMPARISON*. Review of this table indicates that the desalination facility product water quality meets all current DHS water quality MCL standards. The project would also be consistent with all requirements of the SARWQCB Basin Plan. Thus, impacts in this regard would not be significant.

DHS Action Levels

In addition to the Safe Drinking Water Act, which sets the primary and secondary MCLs for water quality constituents, the California DHS has established health-based advisory levels, known as "action levels", for specific chemicals which may be found in drinking water. The levels in Table 5.11-1, *DHS DRINKING WATER NOTIFICATION LEVELS,* provide information to public water agencies and others about certain non-regulated chemicals in drinking water that lack MCLs. Furthermore, Table 5.11-2, *RESPONSE LEVELS*, provides response level information at which DHS recommends removal of a source from service.

Unlike MCLs, which are enforceable regulatory standards, action levels are advisory in nature and not enforceable standards. However, if a chemical is present over its action level, the following apply:

- Local Government Notification;
- Consumer Notification; and
- Removal of a Drinking Water Source from Service – DHS recommends that the drinking water system take the source out of a service if a chemical is present at levels considerably

higher than the action levels. Response levels for these recommendations are presented in Table 5.11-2.

Of all the chemicals listed in Table 5.11-1, boron is the only compound that is detectable in the product drinking water from the seawater desalination facility. After the reverse osmosis treatment process the desalted water boron level is approximately 0.6-0.8 mg/l, which is below the DHS action level.

Table 5.11-1
DHS DRINKING WATER NOTIFICATION LEVELS

Chemical	Notification Level (milligrams per liter)
Boron**	1
n-Butylbenzene	0.26
sec- Butylbenzene	0.26
Tert- Butylbenze	0.26
Carbon disulfide	0.16
Chlorate**	0.8
2-Chlorotoluene	0.14
4-Chlorotoluene	0.14
Dichlorodifluoromethane (Freon 12)**	1
1,4-Dioxane	0.003
Ethylene glycol	14
Formaldehyde	0.1
Isopropylbenzene**	0.77
Manganese**	0.5
Methyl isobutyl (MIBK) **	0.12
Naphthalene	0.017
N-Nitrosodiethylamine (NDEA)	0.00001
N-Nitrosodiethylamine (NDMA) **	0.00001
Perchlorate**	0.006
n-Propylbenzene	0.26
Teritiary butyl alcohol (TBA) **	0.012
1,2,3-Trichloropropane (1,2,3-TCP) **	0.000005
1,2,4-Trimethylbenzene**	0.33
1,3,5-Trimethylbenzene**	0.33
Vanadium**	0.05
Source: California Department of Health Services, “Drinking Water Action Levels: An Overview”. **Chemical was detected two or more times in at least one drinking water source 2002-2004.	

Table 5.11-2
RESPONSE LEVELS
(at which DHS recommends removal of a source from service)

Chemical	Toxicological Endpoint	Response Level (Multiples of Notification Level)
1,4-Dioxane TBA 1,2,3-TCP	Cancer Risk	100 times the NL
NDMA	Cancer Risk	20 times the NL
NDEA	Cancer Risk	10 times the NL
All Others	Cancer Risk	10 times the NL
Source: California Department of Health Services, “Drinking Water Action Levels: An Overview”.		

Table 5.11-3
PRODUCT WATER QUALITY COMPARISON

	Primary MCL or (Secondary MCL)	Projected Water Quality Huntington Beach Desalination Facility (Average)	Seal Beach Potable Groundwater (2001 CCR)	Fountain Valley Potable Groundwater (2001 CCR) (Average)	Newport Beach Potable Groundwater (2001 CCR) (Average)	Irvine Ranch Water District (Groundwater) (2001 CCR) (Average)	MWDSC Diemer Filtration Plant (2001 CCR) (Average)
INORGANICS							
Aluminum (µg/L)	1,000 /(200)	10	<DLR	<DLR	<DLR	10	123
Antimony (µg/L)	6	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Arsenic (µg/L)	10	0.01	<DLR	<DLR	<DLR	2.7	2.3
Barium (µg/L)	1,000	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Beryllium (µg/L)	4	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Cadmium (µg/L)	5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Chloride (mg/L)	(250)	180	13	36	57	14	69
Chromium, total (µg/L)	50	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Color (Units)	(15)	1	<DLR DS	1.8 DS	<DLR DS	<DLR DS	1
Copper (µg/L) 90th percentile	*	10 (at plant)	180 R	160 R	270 R	190 R	<DLR
Cyanide (µg/L)	150	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Fluoride (mg/L)	2.0	0.15	0.37	0.3	0.34	0.29	0.2
Iron (µg/L)	(300)	2	<DLR	<DLR	<DLR	<DLR	<DLR
Lead (µg/L) 90th percentile	*	0.5 (at plant)	3.1 R	<DLR	<DLR	1.2	<DLR
Manganese (µg/L)	(50)	<DLR	<DLR	<DLR	<DLR	39	<DLR
MBAS (mg/L)	0.5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Mercury (µg/L)	2	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Nickel (µg/L)	100	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Nitrate (mg/L as NO3)	45	0.5	<DLR	3.3	7.5	<DLR	<DLR
Nitrite (mg/L as N)	1	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Odor (TON)	(3)	1	<DLR DS	1 DS	1.7 DS	<DLR DS	No data
Selenium (µg/L)	50	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Silver (µg/L)	100	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Specific Conductance (µmhos/cm)	(900)	720	359	589	730	399	732

"<DLR" (less than the Detection Limit for Reporting purposes) means the contaminant would not be detected at or above the analytical reporting level established for each contaminant by the California Department of Health Services.
"DS" means samples are collected for compliance purposes from the distribution system, not at the well/treatment plant.
"R" means samples for lead and copper compliance are collected from residential taps, not at the well/treatment plant.

Table 5.11-3
PRODUCT WATER QUALITY COMPARISON (cont'd)

	Primary MCL or (Secondary MCL)	Projected Water Quality Huntington Beach Desalination Facility (Average)	Seal Beach Potable Groundwater (2001 CCR)	Fountain Valley Potable Groundwater (2001 CCR) (Average)	Newport Beach Potable Groundwater (2001 CCR) (Average)	Irvine Ranch Water District (Groundwater) (2001 CCR) (Average)	MWDSC Diemer Filtration Plant (2001 CCR) (Average)
Specific Conductance (μmhos/cm)	(900)	720	359	589	730	399	732
Sulfate (mg/L)	(250)	10	26	67	109	40	149
Thallium (μg/L)	2	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
TDS (mg/L)	(500)	300	227	360	481	243	432
Turbidity (NTU)	(5)	<DLR DS	0.1 DS	0.16 DS	0.02 DS	<DLR DS	0.06
Zinc (μg/L)	(5,000)	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
RADIOACTIVITY (pCi/L)							
Gross alpha	15	<DLR	<DLR	4.7	5.3	1.4	3.6
Gross beta	50	<DLR	No data	No data	No data	No data	6.2
Radium 226 and 228	5	<DLR	No data	No data	No data	No data	<DLR
Strontium 90	8	<DLR	No data	No data	No data	No data	No data
Tritium	20,000	<DLR	No data	No data	No data	No data	No data
Uranium	20	<DLR	No data	4.9	5.2	No data	2.6
VOLATILE ORGANICS (μg/L)							
Benzene	1	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Bromoform	THM	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Carbon tetrachloride	0.5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Chlorodibromomethane	THM	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Chloroform	THM	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,2–Dichlorobenzene	600	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,4–Dichlorobenzene	5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Dichlorobromomethane	THM	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,1–Dichloroethane	5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,2–Dichloroethane	0.5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,1–Dichloroethylene	6	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR

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Table 5.11-3
PRODUCT WATER QUALITY COMPARISON (cont'd)

	Primary MCL or (Secondary MCL)	Projected Water Quality Huntington Beach Desalination Facility (Average)	Seal Beach Potable Groundwater (2001 CCR)	Fountain Valley Potable Groundwater (2001 CCR) (Average)	Newport Beach Potable Groundwater (2001 CCR) (Average)	Irvine Ranch Water District (Groundwater) (2001 CCR) (Average)	MWDSC Diemer Filtration Plant (2001 CCR) (Average)
t–1,2-Dichloroethylene	10	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Dichloromethane	5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,2–Dichloropropane	5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,3–Dichloropropene	0.5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Ethylbenzene	300	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Monochlorobenzene	70	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
MTBE	13	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Styrene	100	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,1,2,2–Tetrachloroethane	1	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Tetrachloroethylene	5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Toluene	150	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,2,4–Trichlorobenzene	5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,1,1–Trichloroethane	200	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,1,2–Trichloroethane	5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Trichloroethylene	5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Trichlorofluoromethane	150	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,1,2-Trichlorotrifluoroethane	1,200	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Vinyl Chloride	0.5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Xylenes	1,750	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
SYNTHETIC ORGANICS (µg/L)							
Alachlor	2	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Atrazine	1	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
gamma-BHC (Lindane)	0.2	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Bentazon	18	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Carbofuran	18	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR

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Table 5.11-3
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Chlordane	0.1	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
2,4-D	70	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Dalapon	200	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
1,2–Dibromo–3–chloropropane	0.2	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Di (2-ethylhexyl)adipate	400	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Di (2-ethylhexyl)phthalate	4	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Dinoseb (μg/L)	7	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Diquat	20	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Endothall	100	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Endrin	2	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Ethylene dibromide	0.05	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Glyphosate	700	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Heptachlor	0.01	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Heptachlor epoxide	0.01	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Hexachlorobenzene	1	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Hexachlorocyclopentadiene	50	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Methoxychlor	30	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Molinate	20	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Oxamyl	50	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Pentachlorophenol	1	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Picloram	500	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Polychlorinated biphenyls	0.5	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Simazine	4	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
2,4,5–TP (Silvex)	50	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
Thiobencarb	70	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR

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Table 5.11-3
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Toxaphene	3	<DLR	<DLR	<DLR	<DLR	<DLR	<DLR
MICROBIALS (MPN/100ml)							
Total Coliform - % positives	**	0.1	0	0	0	1.2	0.2 DS
Fecal Coliform - % positives	**	0	0	0	0	0	0
OTHER ANALYSES (mg/L)							
Alkalinity		50	No data	169	179	No data	104
Total Hardness		50	No data	63	79	No data	49
Magnesium		15	No data	11	13	No data	21
pH (Units)		8.0	No data	8.0	8.0	No data	8.0
Potassium		5.0	No data	2.5	3.5	No data	3.5
Sodium		120	60	43	55	52	65

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"R" means samples for lead and copper compliance are collected from residential taps, not at the well/treatment plant.

PRODUCT WATER RELIABILITY

The desalination facility operations would be fully automated and key systems would be provided with redundant equipment and controls per the requirements of Title 22 of the California Code of Regulations. In the event of an underground booster pump station power outage, the booster pump station would be equipped with on-site power generators that would allow their operation to continue even if the main source of power supply has been interrupted. The desalination facility would be provided with two independent sources of power supply, which includes an electrical power grid and/or the HBGS auxiliary reserve bank to assure uninterrupted operations during emergencies. The desalination facility would be manned 24 hours per day, 365 days per year by skilled and certified operators, which would coordinate facility and pump station operations with that of all other water purveyors delivering water to or operating the water distribution system facilities.

As a part of desalination and pumping station operations, the operations staff would develop an earthquake mitigation and preparedness plan, which would be coordinated with the City of Huntington Beach. This plan would define coordination measures to assure continuous facility operations and water delivery under earthquake emergency conditions.

The desalination facility would be designed with one standby reverse osmosis train to provide additional reliability of water production and supply. Typically, desalination facilities, including the existing desalination facilities in California, are designed to operate with all available reverse osmosis trains in operation at all times. During the times of potential outages caused by scheduled or unscheduled maintenance or emergency events, such as an earthquake, these facilities operate at reduced capacity or are down for a certain period of time. The proposed desalination facility would be designed to produce 50 mgd of product water with 12 RO trains, and would be constructed with an additional 13th RO standby train, which can produce up to 4.2 mgd of water at any time. This additional train would provide increased reliability and redundancy that exceeds current reliability standards and common practices for desalination facility design. The proposed desalination facility would be the first facility in California with such additional production standby capacity and reliability provisions.

The issues of reliability of the supply and emergency service provisions would be dictated by the terms of the institutional agreements negotiated with the regional water purveyors (including MWDOC and Metropolitan Water District) and by the terms of the water supply agreements negotiated with potential customers that would purchase the product water produced at the desalination facility. Thus, impacts are anticipated to be less than significant in this regard with mitigation.

ORANGE COUNTY WATER DISTRIBUTION SYSTEM

The introduction of desalinated product water into the existing Orange County distribution system may result in impacts in regards to the following:

- Blended Water Quality
- Blended Water Corrosivity
- Blended Water Chlorine Residual
- Blended Water Disinfection Byproduct Concentration
- Blended Water Taste and Odor
- Hydraulics

Blended Water Quality

Due to distribution system operations at certain points in the system, desalinated water may blend with other source waters, such as local groundwater or imported water from the Metropolitan Water District of Southern California. This blending could have water quality improvement benefits, especially if the receiving agencies are predominantly using imported water, which has higher levels of TDS, sulfate, hardness and disinfection byproducts than desalinated water.

The desalination facility would produce drinking water of very high and consistent quality, which meets or exceeds all applicable regulatory requirements established by the EPA and the DHS. The desalinated water would be produced applying state-of-the-art seawater RO membranes which are capable of removing practically all contaminants in the source water: turbidity; taste, odor, color, bacteria, viruses, salts, proteins, asbestos, organics, etc.

Currently, EPA recognizes RO membrane treatment as a best available technology for water treatment and for meeting future water quality regulations.

The desalinated water would have approximately 100 mg/L lower salinity (i.e. TDS) than the existing drinking water. The lower drinking water salinity would result in better taste and lower overall water distribution system corrosivity. The desalinated seawater would be softer than the existing water sources. Softer water has a number of benefits such as: better taste; formation of less calcium deposits on household appliances and cutlery; and lower detergent use. Commercial and industrial establishments which currently use softening devices to treat the potable water would also benefit from introduction of the softer desalinated water in the distribution system, as their softening costs may be reduced and some of these users may not need to soften their water anymore (most industrial users typically require water with a hardness below 80 mg/L – as desalinated water would reduce hardness by at least 50 percent, softening costs would also be reduced commensurately). Similar to TDS, drinking water of lower sulfate consternation would have a better taste. The desalinated water would have order-of-magnitude lower disinfection byproducts, such as total trihalomethanes and halocetic acids, or TTHM and HAA, respectively) concentrations than the existing drinking water (refer to Appendix N, *DISINFECTION BYPRODUCT FORMATION STUDY*). Disinfection byproducts are well known carcinogens and their reduction in the drinking water as a result of the blending of the desalinated water with other water sources would be an added benefit. As such, the blending of desalinated product water with existing imported MWD water is not anticipated to result in significant impacts.

Blended Water Corrosivity

Blending the desalinated product water with existing water from other sources may change the water quality of the blend in terms of its corrosion effect on the existing water distribution system. When evaluating potential short-term and long-term impacts of blending treated waters from different sources, one of the most important considerations is the potential for corrosion of pipes and residential fixtures. Excessive corrosion over time might lead to colored water in homes, stained fixtures, pipe failures, and non-compliance with the Lead and Copper Rule. In 1992, the EPA promulgated the Lead and Copper Rule to protect drinking water consumers from excessively high concentrations of lead and copper in the drinking water caused by corrosion of household and public building plumbing systems. The rule sets limits for lead and copper in samples collected from faucets with risk for elevated lead and copper concentrations. The limits for lead and copper are 15 μg/L (micrograms per liter), and 1.3 mg/L, respectively.

Similar to all other potable water sources in the distribution system, product water from the Seawater Desalination Project at Huntington Beach would be chemically conditioned at the treatment facility prior to delivery to the distribution system to mitigate its corrosivity. Lime, in combination with carbon dioxide, would be added for post-treatment stabilization of the RO water as a source for pH and alkalinity adjustment and hardness addition. A corrosion control study describing in detail the type and amount of corrosion control chemicals planned to be used for this project are presented in Appendix O, *DISTRIBUTION SYSTEM CORROSION CONTROL STUDY*.

The product water from the seawater desalination facility would be suitable for delivery through the existing water distribution system and would be comparable and compatible to the other water sources currently delivering water to the same system. Prior to delivery to the water distribution system the desalinated water would be conditioned using lime and carbon dioxide to achieve the following corrosion control driven water quality parameters, which are known to be consistent with water currently distributed throughout Orange County:

- pH of 8 to 8.5;
- Langelier Saturation Index (LSI) of 0.0 to 0.5; and
- Alkalinity of 40 mg/L or higher.

These water goals are established based on current practices of the MWD, MWDOC, and most water agencies and municipalities in Orange County. The water goals are rooted in the Safe Drinking Water Act's water quality standards.

These water quality goals would be achieved by the addition of the following chemicals:

- Lime at dosage of 25 to 50 mg/L (average of 30 mg/L)
- Carbon dioxide at dosage of zero to 30 mg/L (average of six mg/L)

Adopting this proven corrosion control strategy would result in a non-corrosive product that can be seamlessly integrated into the system.

In addition, a corrosion monitoring system would be installed in the proposed transmission pipeline at points of interconnection with the existing water distribution system to ensure that the proposed corrosion control measures are effective and adequate. As such, impacts in regards to corrosion are not anticipated to be significant upon implementation of the design features described above.

Chlorine Residual

The disinfected desalinated water may impact the disinfection of the existing water sources. The potential impacts include a change in the concentration of disinfection byproducts and a reduction of chloramine residual in the other water sources with which desalinated water is blended. The potential impacts and their assessment are described in detail in a separate study provided in Appendix N, *DISINFECTION BYPRODUCT FORMATION STUDY*.

The desalinated product water would be disinfected prior to delivery to the distribution system. Chlorine, in the form of sodium hypochlorite, would be added as a disinfectant to meet DHS water quality standards for potable water disinfection. The desalted water would meet current imported water disinfection methods so as to not change any disinfection protocol currently being used by water agencies. Controlling biological growth in the transmission pipelines and in the receiving reservoirs in the distribution system would be accomplished by adding ammonia to the chlorinated water to form chloramines. Potable water from MWD as well as that from some local groundwater sources also contains chloramines as the final residual disinfectant. All of these treated water sources would have compatible chlorine residuals.

The desalinated water would be chloraminated by sequential application of sodium hypochlorite and ammonia to achieve a chloramine residual concentration at the point of delivery to the distribution system is in a range of two to 2.5 mg/L. A detailed description of the proposed chloramination process is provided in Appendix N, *DISINFECTION BYPRODUCT FORMATION STUDY.* This study confirms that after blending of the chloraminated product water from the desalination facility with disinfected product water from other sources, the chloramine residual of the blend meets the target level in the distribution system of two to 2.5 mg/L. As such, impacts in this regard are not anticipated to be significant.

Disinfection Byproduct Concentration

The desalinated product water may impact the content of disinfection byproducts (known to be carcinogenic) of existing water sources within the distribution system. The two key groups of regulated disinfection byproducts that can be impacted are TTHMs and HHAs. The desalinated water typically has higher concentration of bromides than the other water sources. Bromides may create additional disinfection byproducts. Therefore, when blended with other source waters, the desalinated water may increase the concentration of disinfection byproducts in the other sources. On the other hand, the existing water sources in Orange County typically contain much higher level of organics than the desalinated water, which is practically void of organics. Organics are also a potential source of disinfection byproducts. Therefore, blending of desalinated water with other water sources may have a positive impact on water sources with high organic concentrations.

Blending desalinated water with existing sources of supply would result in a product that is comparable to existing supplies and meets all disinfection byproduct limits. Desalinated seawater contains lower levels of organics than existing Orange County sources, such as the MWD's Diemer filtration facility and all other local groundwater water sources. Therefore, blending of desalinated water with other source waters in the distribution system would have a beneficial effect, and would lower the overall disinfection byproduct concentration of the blend. The results of Appendix N, *DISINFECTION BYPRODUCT FORMATION STUDY* confirm the beneficial effect of the desalinated water on the blended water quality in terms of disinfection byproducts. As such, impacts in this regard are not anticipated to be significant.

Blended Water Taste and Odor

No measurable impact on odor is expected as a result of the integration of the desalinated water with water from other sources in the distribution system. The desalinated water would be softer and would have lower salinity than the other water sources. Therefore, blending of these sources would result in an overall reduction of the salinity and hardness of the water delivered to the customers. Lower salinity and hardness of the blended product water would be beneficial and would have a positive effect on the taste of the water delivered to the customers.

As shown in Table 5.11-3, *PRODUCT WATER QUALITY COMPARISON*, the projected quality of the project water after RO treatment is closely comparable with the finished water it would blend with in the distribution system. In terms of odor, the desalination facility product water would meet the DHS MCL. In terms of regulated volatile organics, and other compounds that may impact product water taste and odor, product water from the Seawater Desalination Project at Huntington Beach would comply with all drinking water standards and does not differ substantially from the water quality of the other sources of product water in the distribution system. Therefore, the desalinated water would be better than or equal to existing water sources in the distribution system in terms of taste and odor. With pores ranging from 0.00005 to 0.0000002 microns (for comparison, a human hair is 200 microns in diameter) the RO membranes would retain and remove over 99.5 % of the seawater salinity; and over 99 % of the metals and organics which may cause undesirable taste and odor of the product water.

As indicated in Appendix X, *DESALINATION FACILITIES LOCATED THROUGHOUT THE WORLD*, desalinated seawater has been used for over 15 years worldwide without any problems encountered in terms of taste or odor quality. In 1999, Marin County completed a taste and odor survey of desalinated seawater and over 99 percent of the participants in the test indicated that desalinated seawater tasted better than alternative water sources. At a recent water taste testing event in Florida, the product water of the Marco Island seawater desalination facility (which is the second largest seawater desalination facility in the U.S.) was found to be the best tasting water in Southern Florida.

To protect against potential taste and odor problems associated with the startup of facility operations, just prior to startup, a sequential flushing program would be coordinated with the involved water agencies to minimize any sediment disturbance that might occur due to flow reversal in a portion of the existing distribution system. A flushing program would minimize any aesthetic issues that might be created through flow reversal.

In addition, a sampling location would be established near the physical connection of the transmission pipeline to the OC-44 feeder. A monitoring program would be implemented for this location incorporating the following parameters: coliform bacteria, heterotrophic bacteria, chlorine residual, disinfection byproducts, and aesthetic parameters such as turbidity, odor, and color, as well as corrosion indices. The purpose of this sampling point is to verify on a regular basis that no degradation of water quality has occurred during any period of storage at the facility site or in the transmission pipeline and that mixing of desalinated water with water from other sources continues to be compatible.

In summary, because of the close chemical compatibility between the desalinated water produced at the Seawater Desalination Project at Huntington Beach and that of existing water sources in Orange County, no impacts in regards to taste and odor are expected. If such problems occur, the desalination facility water quality can be adjusted by controlling the RO membrane system removal efficiency in terms of particular compounds that may cause taste and/or odor issues, or the product water conditioning chemicals can be changed.[2]

Hydraulics

Implementation of the proposed project may have hydraulic impacts on the regional water distribution system. A total of three pump stations would be necessary for operation of the project: 1) a product water pump station at the desalination facility site; 2) the OC-44 underground booster pump station in unincorporated Orange County; and 3) the Coastal Junction underground booster pump station in Irvine. Project implementation could potentially alter the flow rate and pressure of multiple transmission lines serving the vicinity. Based on hydraulic modeling performed for the proposed project, the following water transmission mains in the project vicinity are not anticipated to be impacted by the proposed project (it is assumed that all facilities discussed below have design features to prevent hydraulic surges):

- East Orange County Feeder #2
- Irvine Cross Feeder
- Coast Supply Line
- Aufdenkamp Transmission Main

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[2] The RO membrane system efficiency, in terms of particular compounds, would be controlled by measuring the turbidity of the desalinated water produced by the membrane system. Turbidity monitoring is achieved by installation of turbidimeters on the individual RO membrane trains and a turbidimeter that measures the turbidity of the desalinated water at the point of which the water leaves the facility site. If the turbidity is above a preset level determined by the DHS regulatory requirements, the individual RO membrane trains would be checked for leaks and the defective or failed membrane elements would be replaced.

- ❖ Tri-Cities Transmission Main
- ❖ Newport Beach Wells Supply Line

However, the hydraulic characteristics of the OC-44 pipeline may be affected in one of two ways, depending on whether the pipeline segment in question is east or west of the proposed OC-44 connection point: 1) west of the proposed OC-44 connection point, the flow rate and flow direction would remain unchanged, while a change in water pressure would be negligible (a change of less than five psi); and 2) east of the proposed connection point, the direction of flow would be reversed, the flow rate would increase, and water pressure would decrease. It is anticipated that maximum flow velocity through this portion of the pipeline would be 7.5 fps. All flow rate, pressure, and velocity changes, which may occur in the existing pipelines, are within pipeline design specifications.
In addition, the hydraulic characteristics of the East Orange County Feeder No. 2 (EOCF #2) may be affected in one of two ways, depending on whether the pipeline segment in question is north or south of the Coastal Junction (the point at which the Tri-Cities and Aufdenkamp Transmission Mains connect to the EOCF #2): 1) north (upstream) of the Coastal Junction, the flow rate within EOCF #2 would decrease (this decrease may allow water pressure to rise, but the resulting change in water pressure would be well within allowable design pressure for the existing pipeline); and 2) south (downstream) of the Coastal Junction, the direction of flow would be reversed, the water pressure would rise, and the flow rate would increase to a maximum velocity of 3.6 fps. Based on the hydrodynamic model, the pressure class of the existing pipeline is of sufficient strength to accommodate changes incurred by the proposed project. Thus, impacts in this regard would not be significant.

<u>Pressure Surges</u>

Appendix D, *PRESSURE SURGE ANALYSIS*, provides a discussion of potential impacts of the three pump stations associated with the project. The report includes the effect of pressure surges on:

- ❖ The proposed desalinated water 42- to 48-inch pipeline (between the desalination facility and the OC-44 transmission main)
- ❖ East Orange County Feeder #2
- ❖ Irvine Cross Feeder
- ❖ Coast Supply Line
- ❖ Aufdenkamp Transmission Main
- ❖ Tri-Cities Transmission Main

Analysis concludes that in the event of a loss of power to the booster pump stations, a low-pressure wave is predicted to propogate out from the discharge site of each booster pump station and into the associated pipelines. As the water travels toward its applicable destination (reservoirs, demand locations, and booster pump stations), the low-pressure waves cause the pipeline pressure to fall. Simultaneously, a pressure upsurge wave is predicted to propagate out from the suction side of the OC-44 and Coastal Junction pump stations.

Following the loss of power to the pump station located at the desalination site, a vapor condition is created in the desalinated water conveyance pipeline. When the product water conveyance pipeline is re-pressurized by a reflected waterhammer wave, any vapor cavities that are formed would collapse, and may create extremely high local pressure spikes that may damage the pipeline, resulting in premature corrosion and the development of leaks. When subjected to negative pressure, a leak could become a source of pathogen intrusion. If the piping does not have sufficient strength to withstand a full vacuum, the pipeline could collapse under such low pressures.

To eliminate large negative pressures and the possibility of vapor cavity formation in the delivery pipeline system above, surge protection measures for proposed project facilities are recommended as follows:

- ❖ Incorporation of pressurized surge tanks at booster pump station locations; and
- ❖ Vacuum relief and air release valve improvements.

Hydraulic modifications recommended for the existing water distribution system include the following:

- ❖ Hydraulically operated isolation valves;
- ❖ Elimination of existing valves; and
- ❖ Pressure control valve improvements.

Refer to Appendix D, *PRESSURE SURGE ANALYSIS,* for additional information.

Additional modeling would be performed during the design phase of the project to confirm that the proposed project would not have significant impacts on regional water transmission facilities.

MITIGATION MEASURES

PRODUCT WATER QUALITY

PW-1 Prior to project operations, the applicant shall obtain all required drinking water permits from the California Department of Health Services. These permits are anticipated to consist of:

- ❖ a Wholesale Drinking Water Permit; and
- ❖ an Administrative Change to Retail Agencies' Drinking Water Permit (to include desalinated water from the proposed project as an approved source of supply for their agency).

PW-2 During final design of the proposed project, the applicant shall incorporate the following six provisions to protect water quality in the event of "non-routine" operations at the HBGS (defined as operations such as seawater emergency intake pump shut downs and failures, electricity equipment malfunctions, excessively high temperature of the cooling water, etc.):

- ❖ Automatic control interlock between HBGS pumps and desalination facility intake pumps: The shutdown controls of the desalination facility intake pumps shall be interlocked with the HBGS pumps, so when HBGS pump operation is discontinued to prepare for heat treatment, non-routine or even routine pump shutdown, this would automatically trigger an alarm at the desalination facility along with shutdown of the desalination intake pumps. After this emergency shutdown, the intake pumps shall be started up manually, and the operations staff would be required to check the reason of shutdown with the HBGS staff before restarting the treatment facility intake pumps.

- ❖ Continuous Intake Pump Flow Measurement Devices: Seawater intake pumps shall be equipped with flow meters, which would record the pumped flow continuously. If the intake flow is discontinued for any reason, including non-routine HBGS operations, automatic intake pump shutdown shall occur.

- ❖ Continuous Intake Water Temperature Measurement Devices: The desalination facility intake pump station shall be equipped with instrumentation for continuous measurement of the intake temperature. Any fluctuations of the intake temperature outside preset normal limits shall trigger alarm and intake pump shutdown. This monitoring equipment shall provide additional protection against heat treatment or other unusual intake water quality conditions.

- ❖ Continuous Intake Water Salinity/Conductivity Measurement Devices: The desalination facility intake pump station shall be equipped with instrumentation for continuous measurement of the intake seawater salinity. Any fluctuations of the intake salinity outside preset normal operational limits shall trigger an alarm and initiate intake pump shutdown. This monitoring equipment shall provide additional protection against discharge of unusual fresh water/surface water streams in the facility outfall.

- ❖ Continuous Intake Water Oil Spill/Leak Detection Monitoring Devices: The desalination facility intake pump station shall be equipped with instrumentation for oil spill/leak detection. Detection of oil in the intake water even in concentrations lower than 0.5 mg/L shall automatically trigger an alarm and initiate intake pump shutdown. This monitoring equipment shall provide additional protection against unusual intake water quality conditions.

- ❖ Routine Communication with HBGS Staff: The desalination facility staff of each shift shall be required to contact HBGS personnel at least once per shift and enquire about unusual planned or unplanned events at the HBGS. If non-routine operations are planned at the HBGS, the desalination facility shall modify desalination facility operations accordingly.

PW-3 During project operations, the RO membrane system shall be continuously monitored for feed seawater and permeate conductivity and the differential pressure through the membranes. If permeate salinity (i.e. total dissolved solids) concentration exceeds the design level, membranes shall be cleaned to recover their original performance capabilities.

PRODUCT WATER RELIABILITY

PW-4 Prior to project operations, the desalination facility operations staff shall develop an earthquake mitigation and preparedness plan, which shall be coordinated with the City of Huntington Beach. This plan shall define coordination measures to assure continuous facility operations and water delivery under earthquake emergency conditions.

ORANGE COUNTY WATER DISTRIBUTION SYSTEM

PW-5 Prior to project operations, a corrosion monitoring system shall be installed in the proposed transmission pipeline at points of interconnection with the existing water distribution system to ensure that the proposed corrosion control measures are effective and adequate.

PW-6 To protect against potential taste and odor problems associated with the startup of facility operations, a sequential flushing program shall be initiated just prior to project startup that shall be coordinated with the involved water agencies to minimize any sediment disturbance that might occur due to flow reversal in a portion of the existing distribution system.

PW-7 Prior to project operations, a sampling location shall be established near the physical connection of the transmission pipeline to the OC-44 feeder. A monitoring program shall be implemented for this location incorporating the following parameters: coliform bacteria, heterotrophic bacteria, chlorine residual, disinfection byproducts, and aesthetic parameters such as turbidity, odor, and color, as well as corrosion indices.

PW-8 Prior to project operations, additional modeling shall be performed to confirm that the proposed project shall not have pressure surge impacts upon the existing regional water distribution system. The model shall recommend appropriate facilities to prevent pressure surges, such as

- Incorporation of pressurized surge tanks at booster pump station locations;
- Vacuum relief and air release valve improvements;
- Hydraulically operated isolation valves;
- Elimination of existing valves; and/or
- Pressure control valve improvements.

PW-9 Prior to project operations, the applicant shall coordinate with and obtain approval as required from applicable local water agencies that own and operate the distribution system in which the desalinated water would come in contact with. Various operating approvals and corresponding agreements shall be signed before the desalinated water is introduced into the local distribution system.

UNAVOIDABLE SIGNIFICANT IMPACTS

None have been identified.